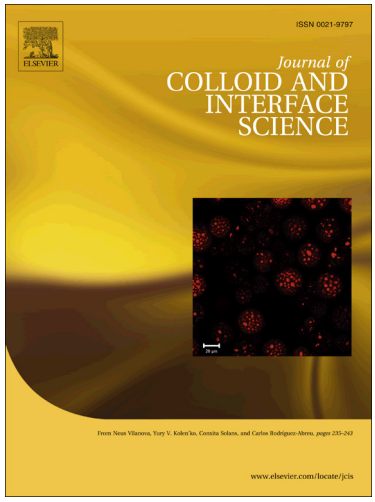


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# Pyrrole-based poly(ionic liquids) as efficient stabilizers for formation of hollow multi-walled carbon nanotubes particles

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**Abstract**

Poly(ionic liquid) (PIL) derivatives with pyrrole intrinsically conducting polymer (ICP) backbones were synthesized and utilized as novel dispersants of multi-walled carbon nanotubes (MWCNTs) in various aqueous and non-aqueous systems, including polar and nonpolar solvents. This is due to the highly tunable nature of the PIL, in which the PILs of varying polarity with the same pyrrole-based polycation can be synthesized. The dispersions are exceedingly stable over many months, and with the addition of hexane, Pickering (solid-stabilized) emulsions with the PIL-stabilized MWCNTs at the droplet interfaces were formed. Depending on the hydrophobicity of the PIL, hexane-in-water and hexane-in-acetonitrile emulsions were formed, the latter marking the first non-aqueous CNT-stabilized emulsions, further advancing the processability of CNTs. The PIL-stabilized CNT Pickering emulsion droplets generated hollow conductive particles by subsequent drying of the emulsions. With emulsion templating, the hollow shells could be used as a payload carrier, depending on the solubility of the payload in the droplet phase of the emulsion. This was demonstrated with silicon nanoparticles, which have limited dispersability in aqueous environments, but great scientific interest due to their potential electrochemical applications. Overall, this work explored a new class of efficient PIL-ICP hybrid stabilizers with tunable hydrophobicity, with hollow particle formation capability.

**Key Words:** Pickering emulsion, carbon nanotube, poly(ionic liquid), intrinsically conducting polymer